

Recent Developments in Active Laser Combat Identification

NDIA Night Operations Symposium
Arlington, VA

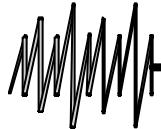
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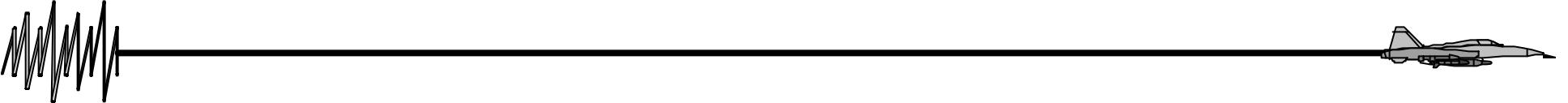


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Mr. Frederick Heitkamp



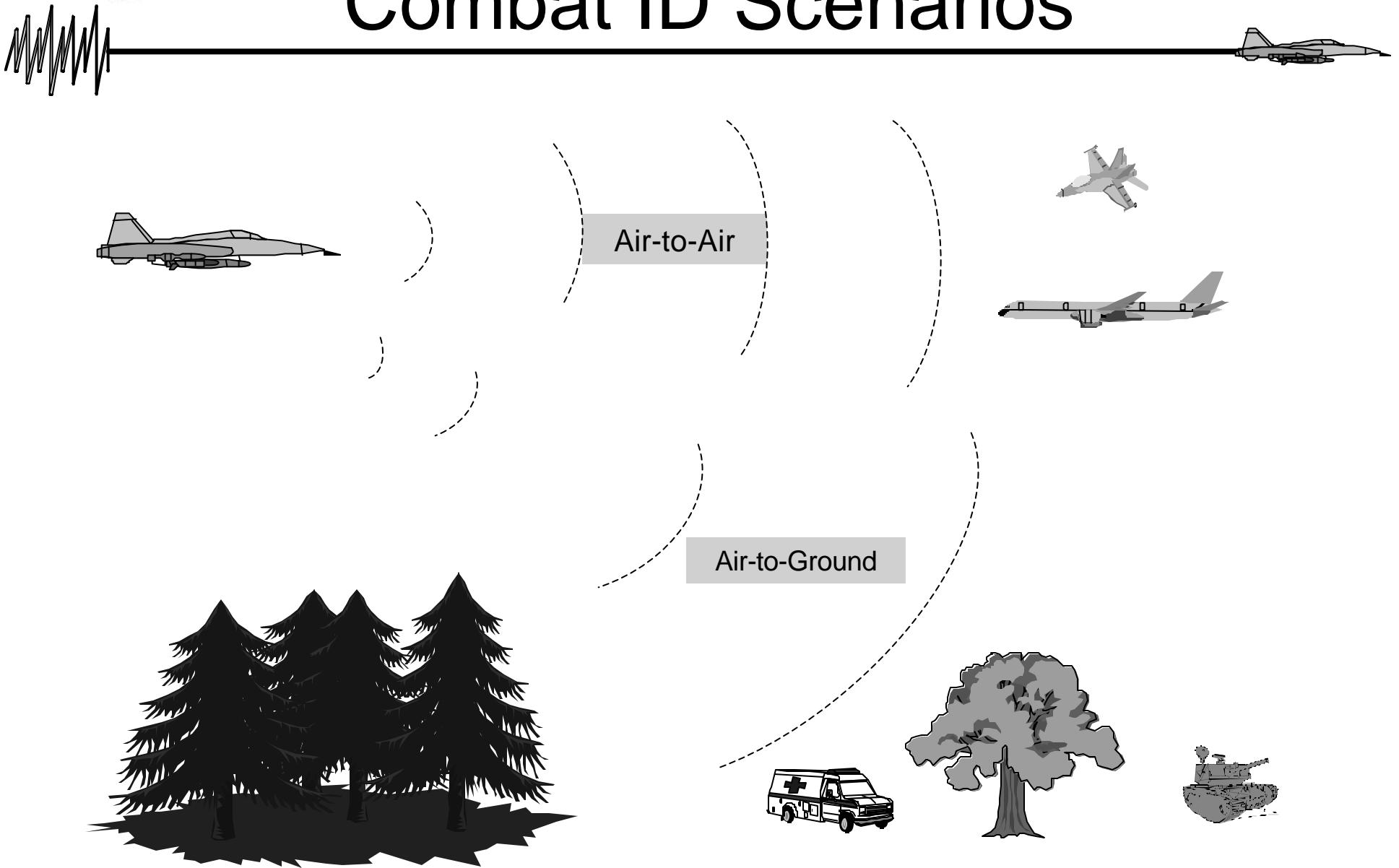
Outline



- Operational Scenarios:
Air-Air, Air-Ground
- Systems Scenarios: Targeting Pods
- Non-Cooperative Identification
Techniques
- Current Directions/Initiatives

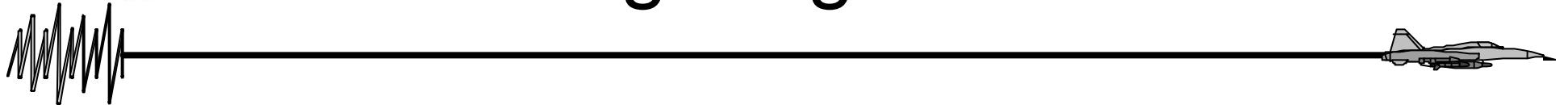


Combat ID Scenarios





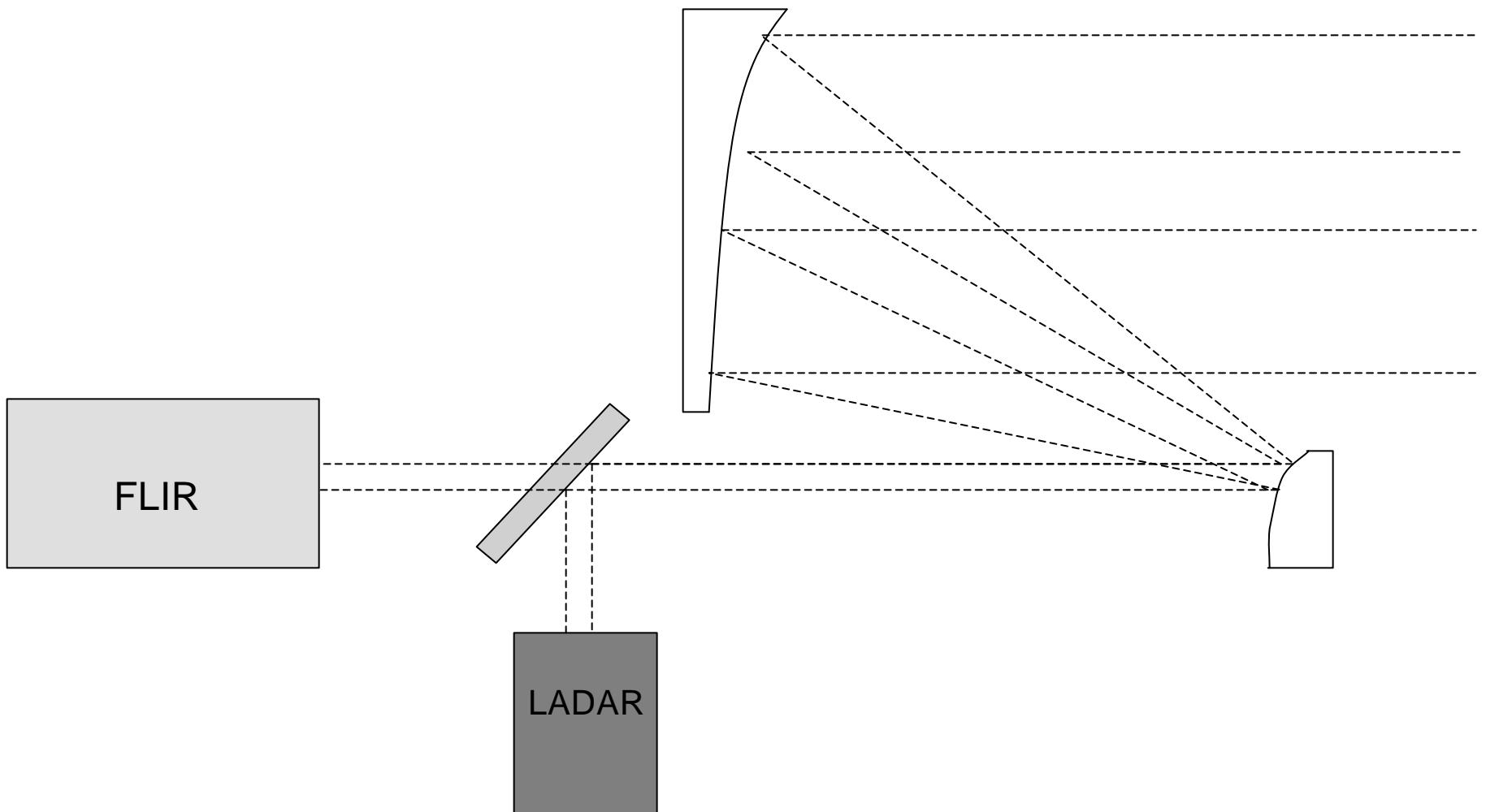
Targeting Pods



- ATFLIR - Raytheon
- LANTIRN - Lockheed-Martin
- NITEHAWK - Northrop-Grumman
- LITENING - Raytheon
- ATP (USAF) - coming soon...

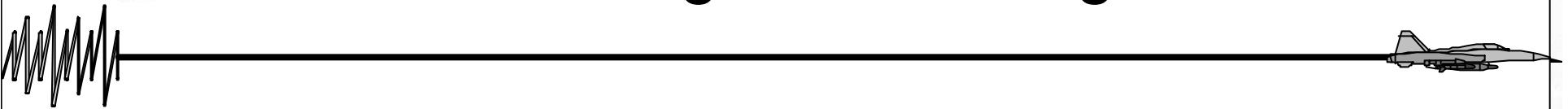


Common Optical Train





Point Interrogation in Image FOV

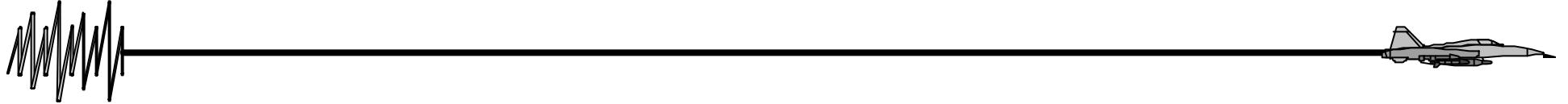


lv019 1372 MFOV DEC = 1 RATE = MED PXC
2221.76443 1tr -58.26 BAR = 1 MODE = TWSA 12.22
-40.78 -38.00 (BPC = Y) -35.21





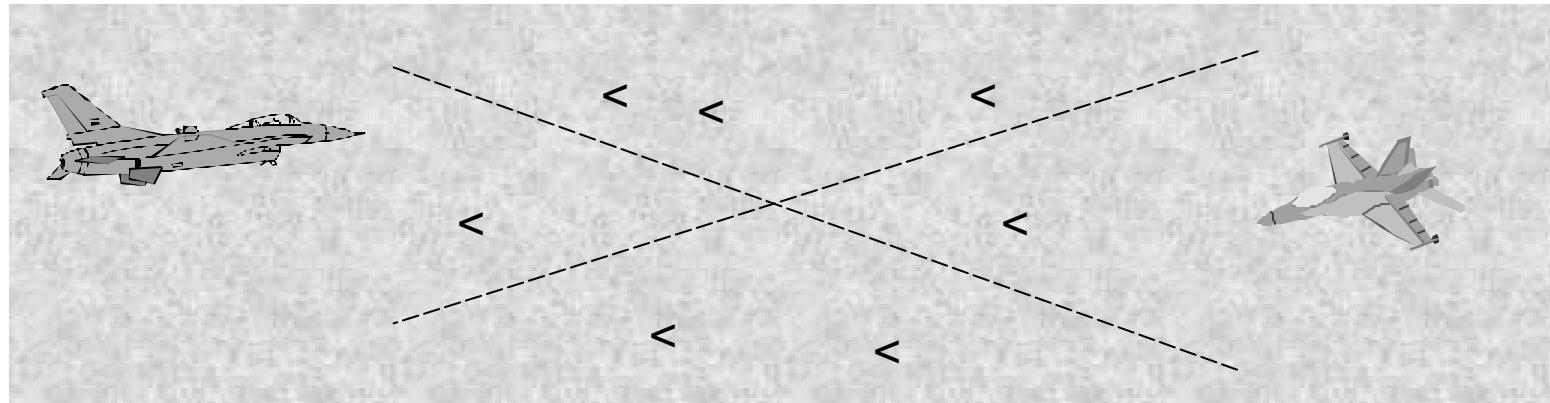
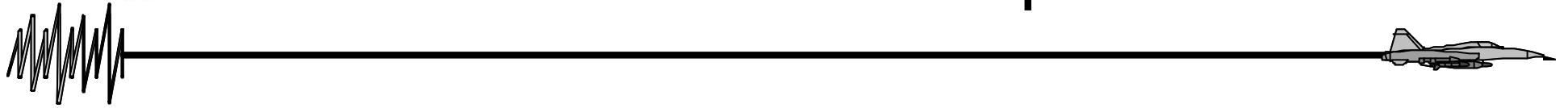
LADAR Combat ID Techniques



- Gated Illumination - Active Imaging
 - > AFRL ERASER 2D - 1.5 micron
 - > Israeli ELBiT - NIR laser, EO camera
- Range Profiling
 - > AFRL ERASER 1D: High range resolution, far term
 - > NAVAIR RAPID: medium resolution, near term
- Surface Mapping - DARPA
- Doppler vibrometry - NAVAIR PTI, AFRL, ONR



Illuminator Concept



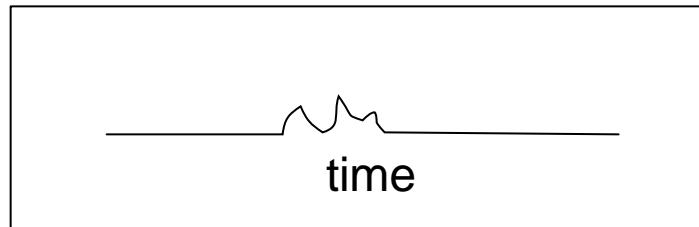
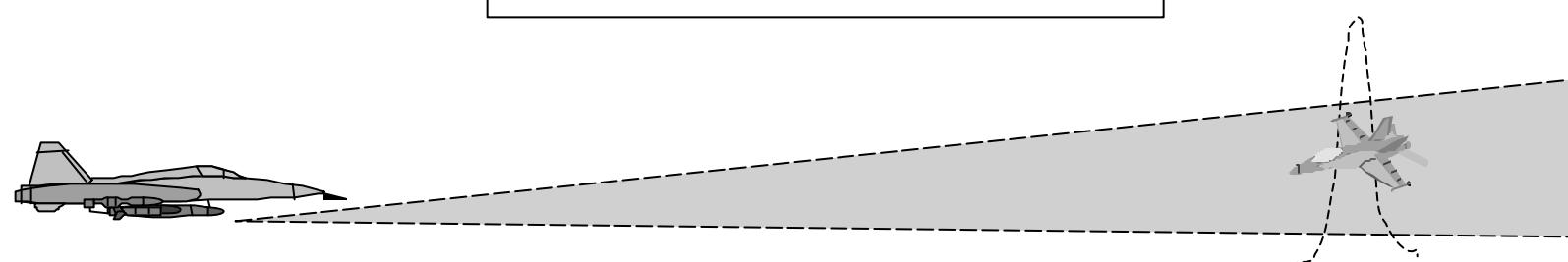
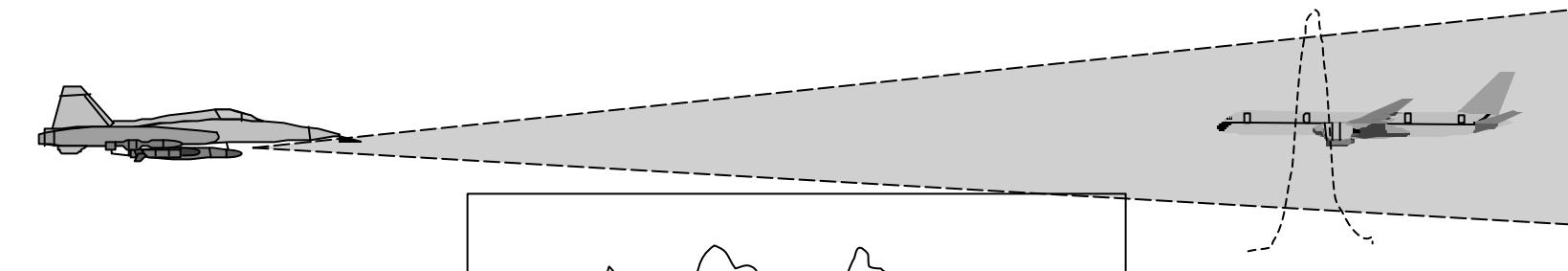
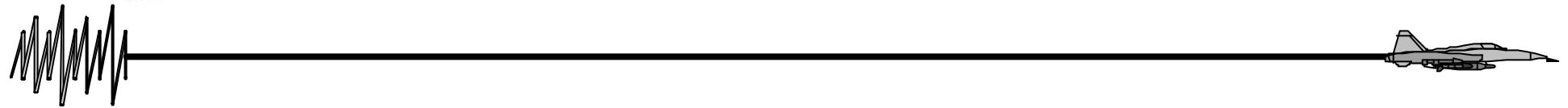
Off

On

Range Gate

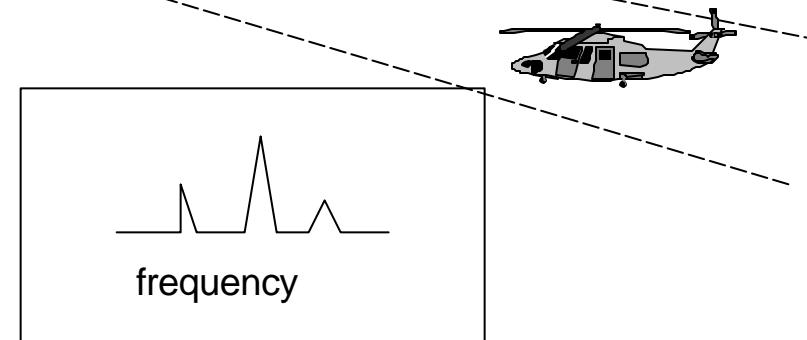
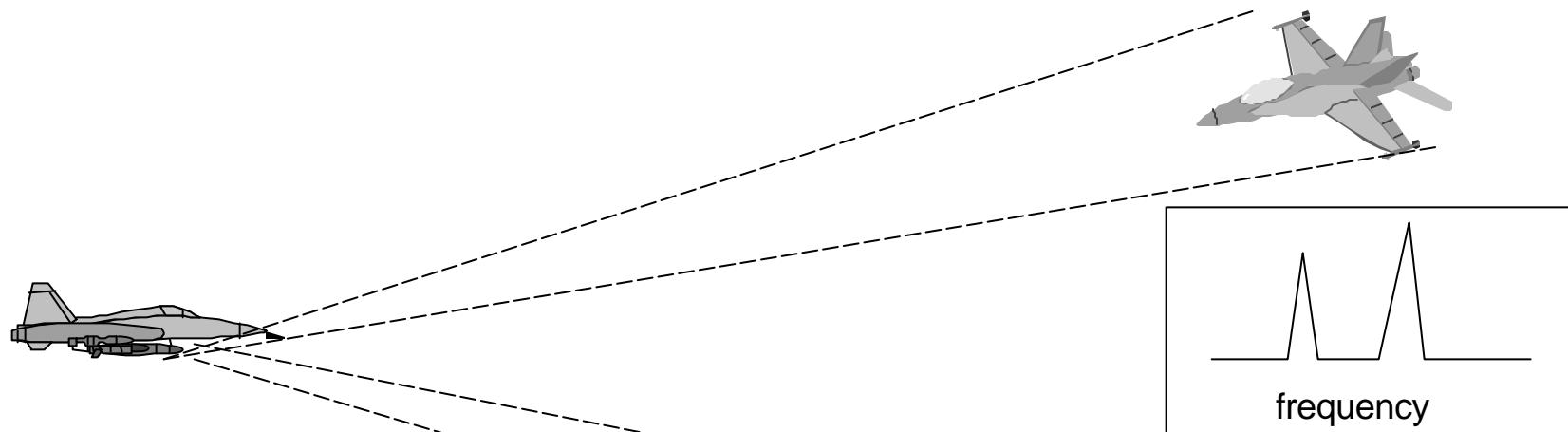


Range-profile identification





Vibrometry Concept





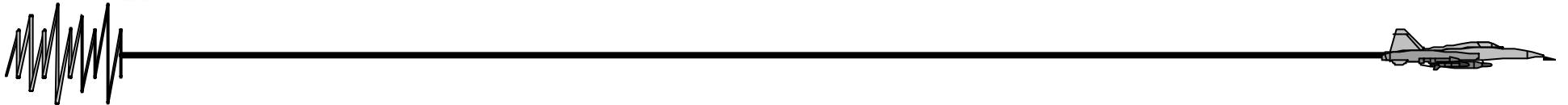
ID vs Detection: target set impact, metrics



	0.8	0.2	0	0	0
	0.2	0.8	0	0	0
	0	0	0.98	0.01	0.01
	0	0	0.01	0.98	0.01
	0	0	0.01	0.01	0.98



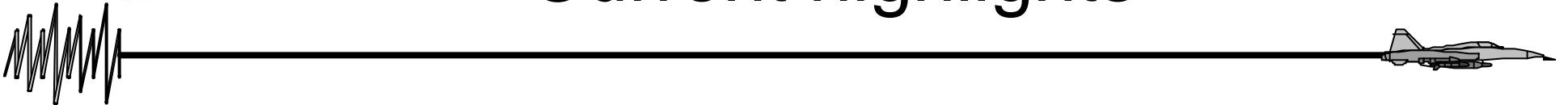
Insertion issues



- Laser Technology
 - > Range Profiling: Direct detection system bandwidth, receiver noise
 - > Vibrometry: LWIR/NIR choice, system stability, platform vibrations coherence
- Engineering CID technology insertion into pods
- Orientation sensitivity
 - Signature base validation
- SNR dependence
- Processing load



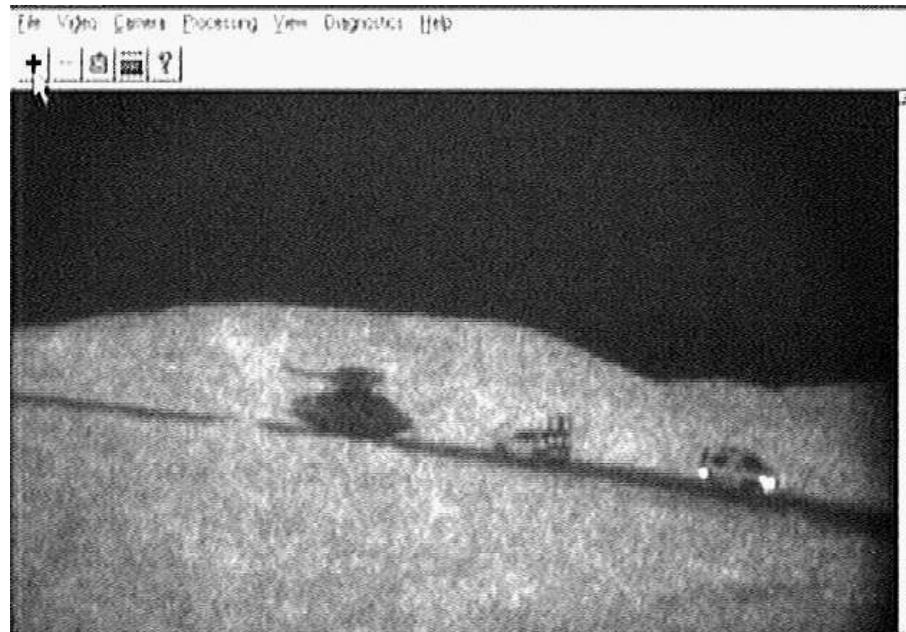
Current highlights



- Active Imaging-NIR Band
- Range Profiling-signal studies
- PTI Laser Vibrometry results
- NATO TG-11 Field Trials
- Doublet Pulse Transmitter Development

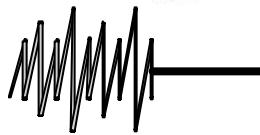


Active Illumination imagery - ELBIT

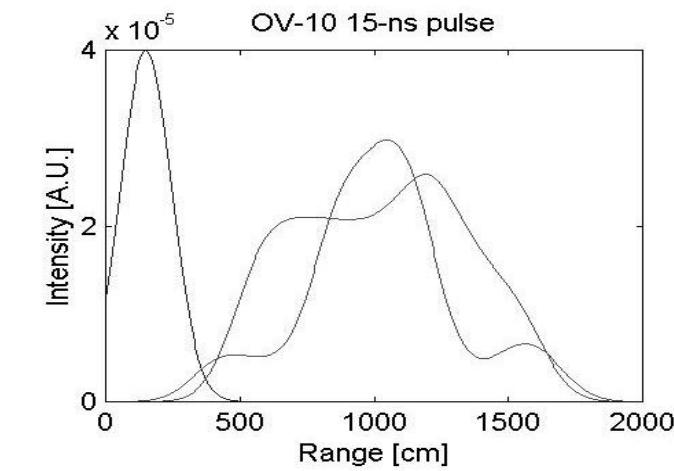
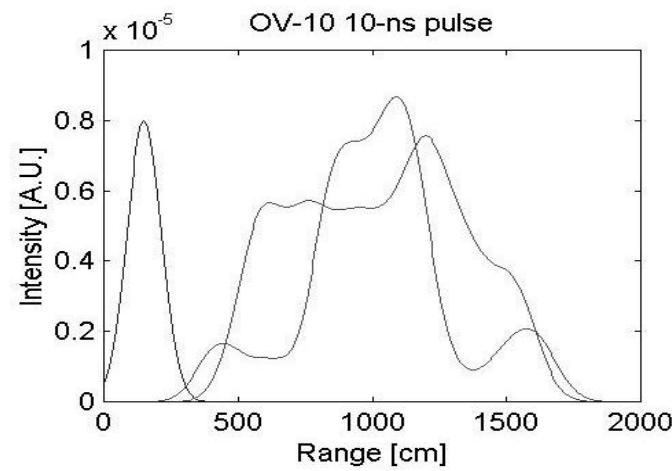
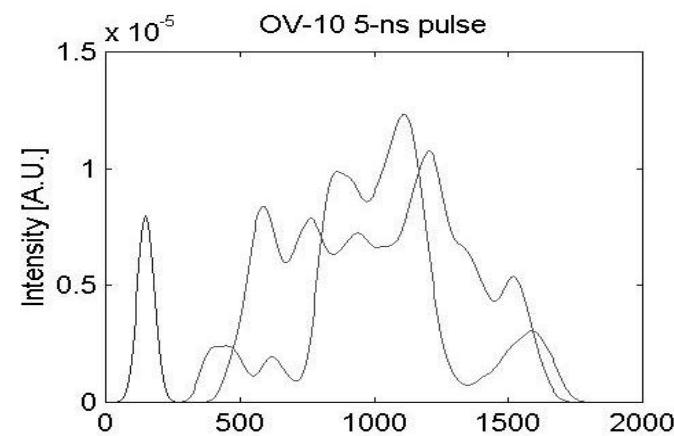
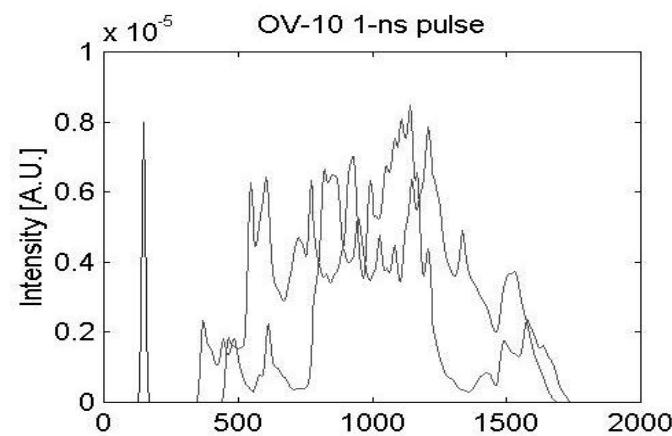


12 km range:

Targets, from left to right: Tank. Toyota corolla (its rear part obscured by a test bar target). A target with three groups of black and white bars on black background. The widths of the bars are: 30, 20 and 15 cm from up to down respectively. A Citroen Berlingo.

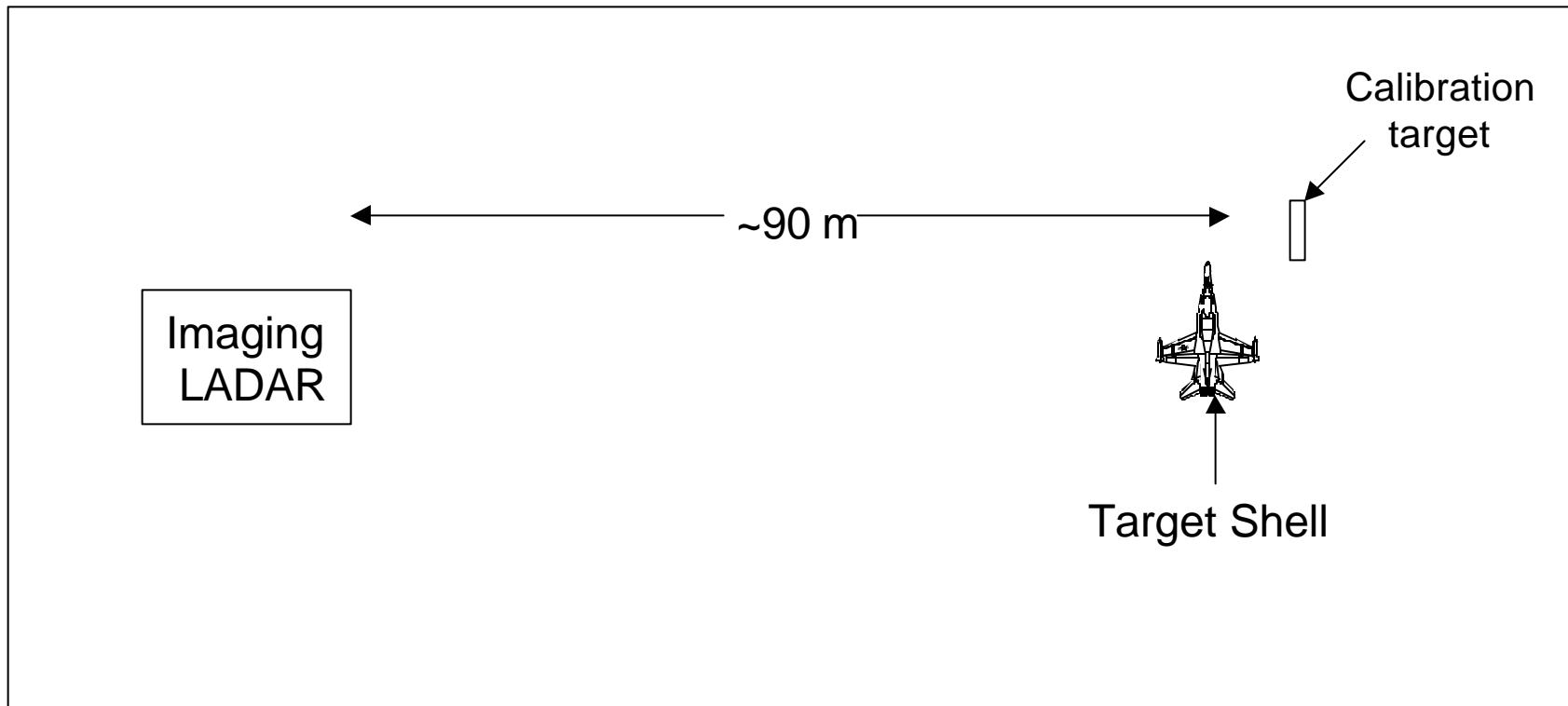
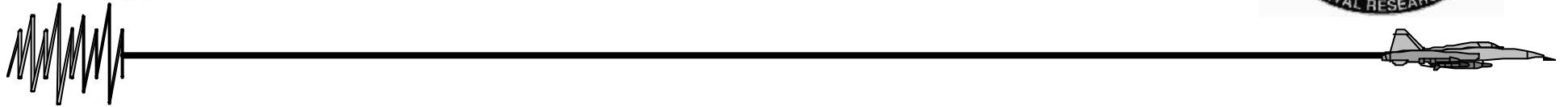


Range profile simulations



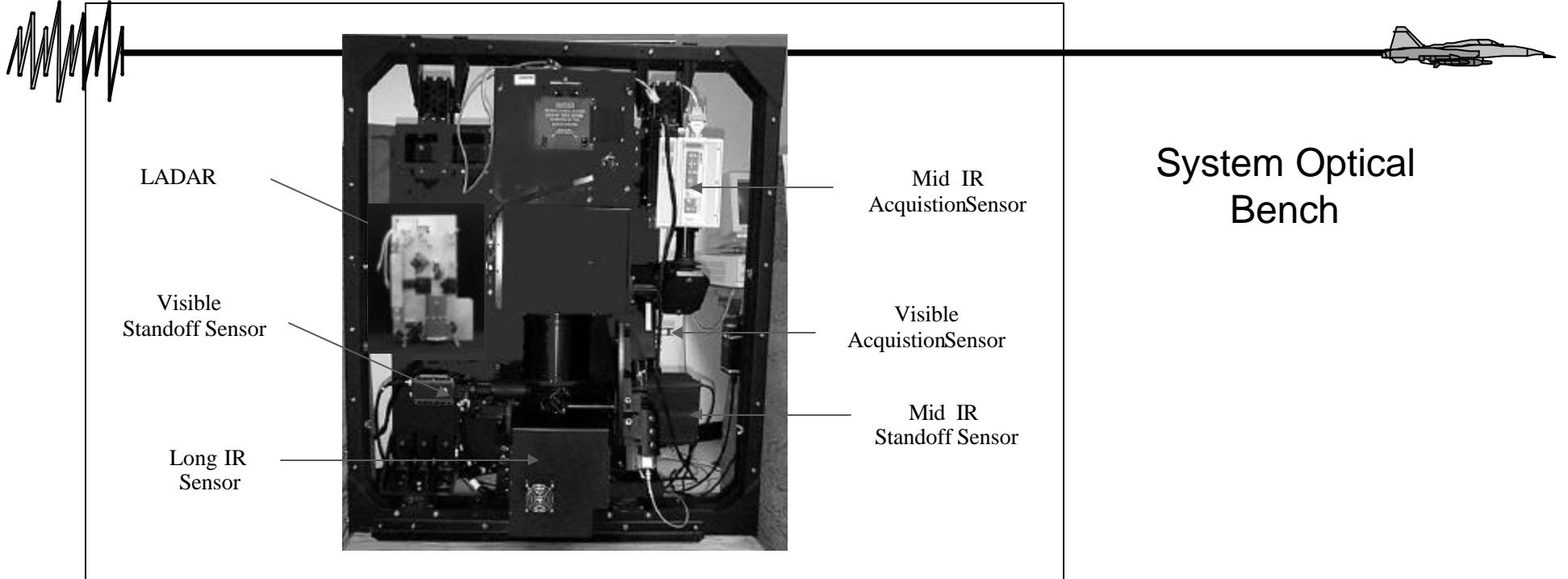


NAWC Range Profile Acquisition





Vibrometry Flight Installation

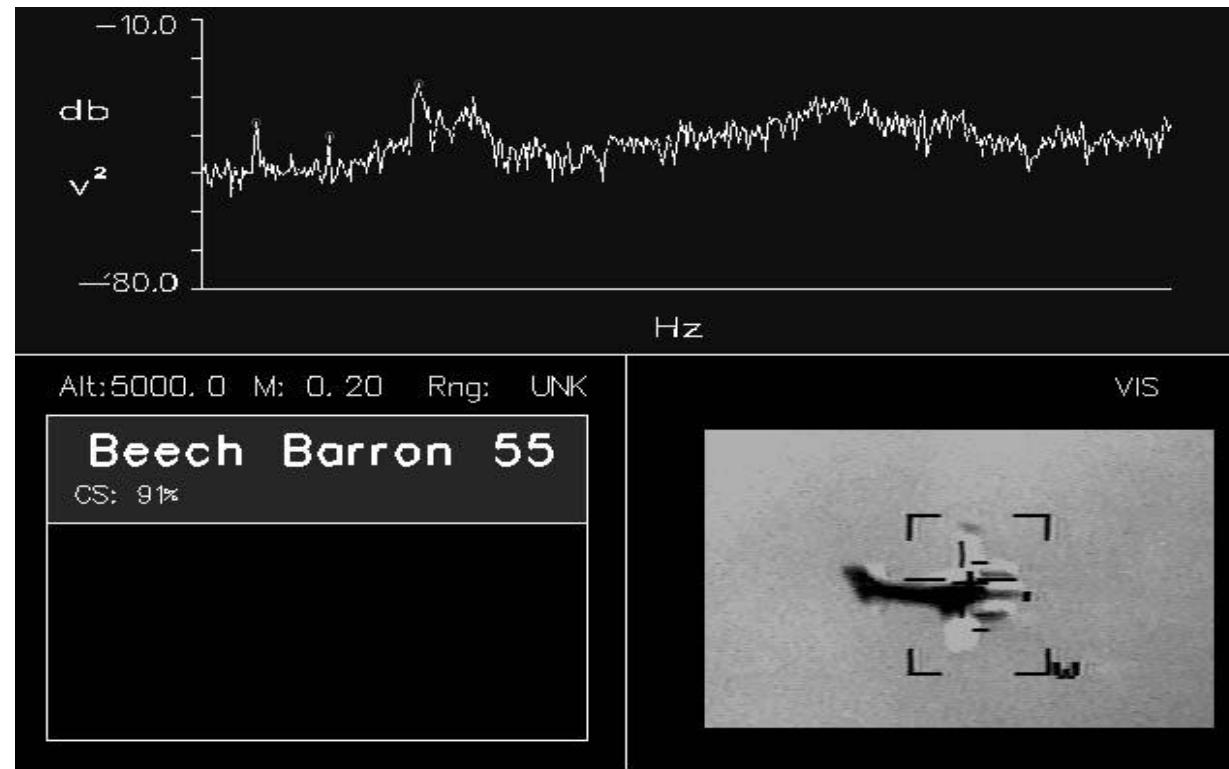
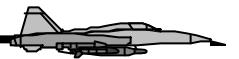
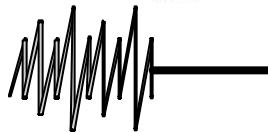


C-130 Installation



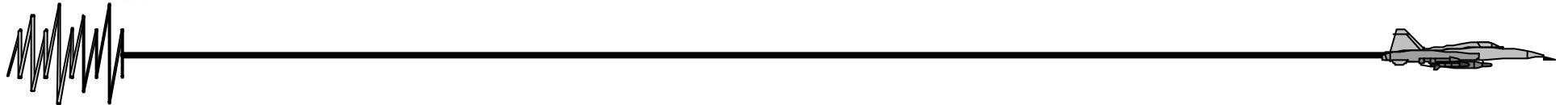


Vibrometry Test Results





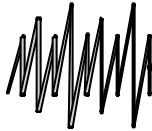
NATO TG-11 Field Trials



- Vibrometry Ground Tests at >10 km
- Wavelengths: $10.6\mu\text{m}$, $2.0\mu\text{m}$, $1.5\mu\text{m}$ in common environment
- HR targets
- Turbulence characterization of path
- July 2001 - WSMR or China Lake



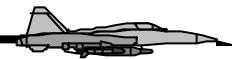
Pulse-Doublet Laser SBIR Effort



- Demonstrate a 50 mJ, 250 Hz all-solid-state 1.3 micron Nd:YAG diode-pumped laser
- Demonstrate over 40% conversion in an SSRL using the above pump laser
- Demonstrate a doublet pulse SSRL, with an average power of >1 W
- Demonstrate microDoppler quality injection seeding of an all-solid-state multi-watt SSRL

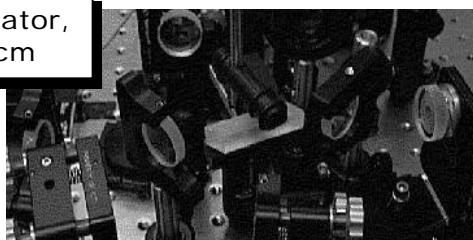


Non-Cooperative Target Identification Radar System



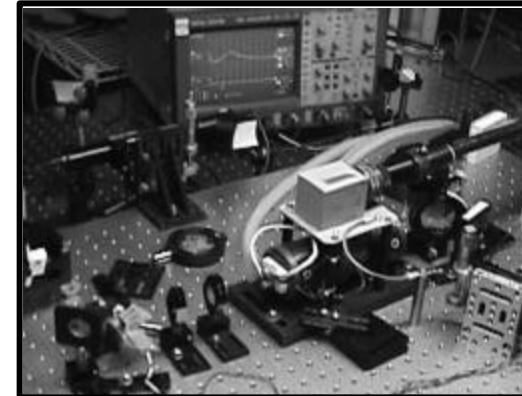
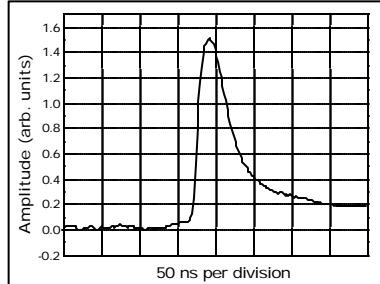
- Coherent Technologies, Inc.
655 Aspen Ridge Drive
Lafayette, CO 80026
- Principal Investigator:
Dr. Duane D. Smith
(303)604-2000 x137
duane@ctilidar.com

SSRL resonator,
< 20x10 cm

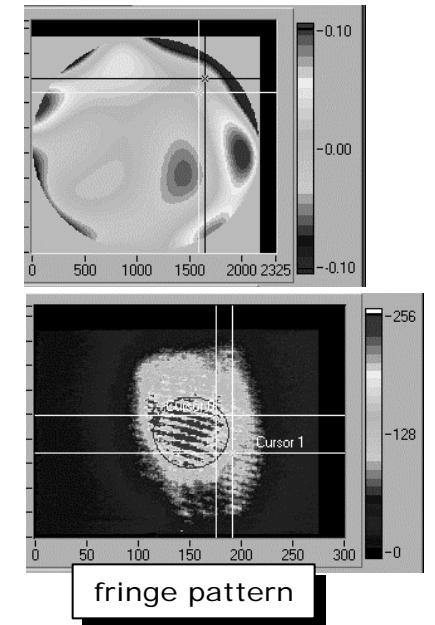


SSRL pulse

Nd:YAG pump laser,
diode pumping available

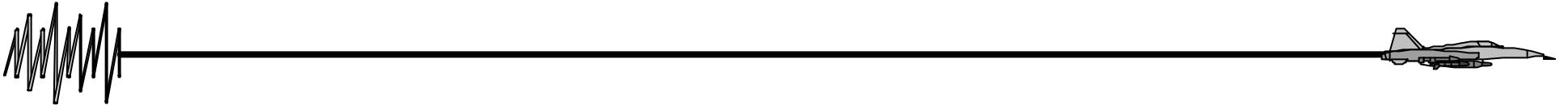


SSRL wavefront,
<0.2 λ p-v at full power





Summary



- Two NCID scenarios with different requirements: Air-Air, Air-Ground
- Major Technology challenges:
 - Laser transmitters
 - Optical receivers
 - Processing
- Systems Opportunities:
 - New starts
 - Insertions